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1313619

(19)

(54) IMPROVEMENTS IN OR RELATING TO GAS-PRODUCING COMBUSTIBLE CHARGES

(71) We, DYNAMIT NOBEL AKTIENGESELLSCHAFT, a German Company, of 521 Troisdorf, near Cologne, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to combustible charges capable of producing gas under pressure.

The principle of using the thrust of gases being formed during a chemical reaction has been utilised in industry in order, for example to operate fire extinguishers or to expel liquids or solids from a container. Other construction forms which employ this principle serve to actuate slides or bolts or to perform other displacement operation. Such uses are described, for example, in the introductory passages of German Patent Specification No. 854,770.

The thrust-producing gases are liberated by single substances or mixtures consisting substantially of combustible gas- and heat-yielding substances. Substances of this type are able to burn in the absence of oxygen, as exemplified by nitrocellulose powder or nitropolystyrene, or alternatively they comprise oxygen-yielding substances, for example potassium chlorate, or gas mixture-yielding substances as in the case of ammonium nitrate or guanidine nitrate. Gas-producing substances are described, for example in German Patent Specifications Nos. 854,770, 854,851, 854,919 and 909,424.

The generation of gases is frequently accompanied by undesirable heat generation and, for this reason, mixtures have been developed which utilise the heat generated during oxidation in a simultaneous endothermic process. Mixtures of this kind contain, for example, ammonium oxalate or hydrocarbons which decompose in an endothermic reaction, for example cyclopentadiene (German Patent Specifications Nos. 882,825 and 1,150,914).

A requirement of all such gas-generating compositions is the evolution of as large a quantity of gas as possible while avoiding any tendency towards explosive self-decomposition of the compositions during the gas evolution. In addition, the compositions should be suitable for handling with a high degree of safety, i.e. the compositions should possess substantial immunity against ignition by friction and impact. It has been found that compositions containing relatively large quantities of guanidine nitrate show a tendency towards an explosion-like reaction which can result in destruction of a container containing the same.

According to one aspect of the invention, there is provided a pressure gas-producing composition intended for use in a device operated by gas under pressure comprising one or more aminoguanidine salts of azotetrazole and/or ditetrazole together with one or more decomposition promoting catalysts in an amount from 0.5 to 5% by weight based on the total composition and/or further gas yielding components.

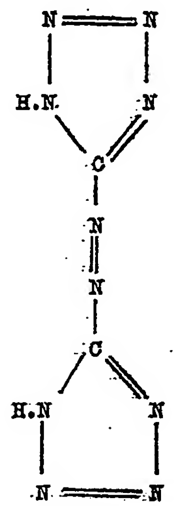
According to a second aspect of the invention, there is provided a pressure gas-producing composition intended for use in a device operated by gas under pressure, comprising from 30 to 98% by weight of the composition of one or more amino-guanidine salts of azotetrazole and/or ditetrazole.

According to a third aspect of the invention, there is provided a pressure gas-producing composition intended for use in a device operated by gas under pressure, comprising from 30 to 99.5% by weight of the composition of one or more aminoguanidine salts of azotetrazole and/or ditetrazole and from 0.5 to 5% by weight, based on the

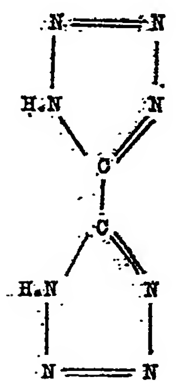
total charge, of one or more decomposition-promoting catalysts.

The aminoguanidine salt(s) of azotetrazole and/or ditetrazole, preferably constitute from 40 to 100% by weight of the gas-producing components of the composition. The composition can contain additional components, including oxygen-yielding and/or other gas-generating substances which do not undergo detonation.

The compound azotetrazole has the formula



and the compound ditetrazole has the formula



The hydrogen atoms of tetrazole rings have an acid reaction and hence form corresponding salts with aminoguanidine. They are prepared for example by combining aqueous solutions of salts of aminoguanidine, for example aminoguanidine sulphate, with aqueous solutions of alkali metal salts of the aforementioned tetrazoles, resulting in precipitation of insoluble compounds which are use in accordance with the invention.

Preferred examples of oxygen-yielding additional components used in minor quantities are chlorates, perchlorates and nitrates of inorganic bases, although it is also possible to use for example nitroguanidine, guanidine nitrate, nitrocellulose, nitropolystyrene, polynitrophenols and polynitrocresols.

Examples of additives which generate gases or gas-mixtures free from oxygen include ammonium oxalate, urea, aminoguanidine, sugar and tartaric acid.

The compositions of the invention can also contain decomposition-promoting catalysts, for example compounds of vanadium, tungsten, molybdenum, chromium and cobalt, especially in the highest oxidation stage of the metals. These compounds should be added to the composition in quantities of from 0.5 to 5% by weight, based on the total composition.

The compositions are prepared for use simply by mixing the constituents. It is possible though not absolutely necessary to compress the solid composition prior to packing in a container therefor.

The following Examples illustrate the invention:—

Example 1

Compressed masses were prepared from a mixture of 500 g. of azotetrazole aminoguanidine and 500 g. of $Ba(NO_3)_2$. These masses were ignited in a pressure tube provided with a nozzle. A powerful gas jet was produced. The masses yielded 350 cc. of gas per gram of mixture. The stability of the masses was confirmed by dropping a 2 kg. weight thereon from a height of 2 metres, when no ignition occurred.

Example 2

Compressed masses were produced from an intimate mixture of 700 g of ditetrazole aminoguanidine and 300 g. of potassium nitrate and ignited in a pressure tube provided with a nozzle by means of an electric primer pellet. The quantity of gas evolved amounted to 400 cc./g. The stability of the masses was confirmed in the same manner as in Example 1.

Example 3

A pressure charge was prepared from 50 g. of $Ba(NO_3)_2$, 50 g. of azotetrazole aminoguanidine, 4 g. of V_2O_5 and 15 g. of an Al-Ti-alloy. After the charge had been ignited by means of a primer charge accommodated in a central ignition tube, it reacted giving off heat in the process. The quantity of heat liberated amounted to 768 cal/g.

Example 4

A pressure charge was prepared from 40 g. of $Ba(NO_3)_2$ and 60 g. of azotetrazole aminoguanidine. After the charge had been ignited using a primer charge which was accommodated in a central ignition tube, it reacted giving off heat in the process. The quantity of heat given off amounted to 613 cal/g.

Example 5

A pressure charge was prepared from 45 g. of $Ba(NO_3)_2$, 45 g. of azotetrazole aminoguanidine and 10 g. of amorphous boron. After the charge had been ignited using a primer mixture which was accommodated in a central ignition tube, it reacted giving off heat in the process. The quantity of heat given off amounted to 826 cal./g.

Example 6

A pressure charge was prepared from 30 g. of $Ba(NO_3)_2$, 50 g. of azotetrazole aminoguanidine and 20 g. of KNO_3. After the charge had been ignited using a primer mixture which was accommodated in a central ignition tube, it reacted giving off heat in the process. The quantity of heat given off amounted to 687 cal/g.

WHAT WE CLAIM IS:—

1. A pressure gas-producing composition intended for use in a device operated by gas under pressure comprising one or more aminoguanidine salts of azotetrazole and/or ditetrazole together with one or more decomposition promoting catalysts in an amount of from 0.5 to 5% by weight based on the total composition and/or further gas yielding components.

2. A pressure gas-producing composition intended for use in a device operated by gas under pressure, comprising from 30 to 98% by weight of composition of one or more amino guanidine salts of azotetrazole and/or ditetrazole.

3. A pressure gas-producing composition intended for use in device operated by gas under pressure, comprising from 30 to 99.5% by weight of the composition of one or more aminoguanidine salts of azeotetrazole and/or ditetrazole and from 0.5 to 5% by weight, based on the total composition, of one or more decompostion promoting catalysts.

4. A composition as claimed in Claim 1 or 3, in which the catalyst is a compound of a metal selected from vanadium, tungsten, molybdenum, chromium, chromium and cobalt.

5. A composition as claimed in Claim 4, in which the metal exists in the compound thereof in its highest oxidation state.

6. A composition as claimed in any one of the preceding claims, in which the aminoguanidine salt or salts comprises from 40 to 100% by weight of the gas-producing components of the composition.

7. A composition as claimed in any one of the preceding claims, which contains one or more oxygen-yielding components.

8. A composition as claimed in Claim 7, in which the oxygen-yielding component is a chlorate, perchlorate or nitrate of an inorganic base.

9. A composition as claimed in any one of the preceding claims, which contains one or more non-oxygen yielding gas-yielding components in addition to said salt.

10. A composition as claimed in Claim 9, in which the non-oxygen yielding gas-yielding component is ammonium oxalate, urea, aminoguanidine, sugar or tartaric acid.

11. A pressure-gas producing composition substantially as described in any one of the foregoing Examples.

12. A pressure-gas producing device, comprising a composition as claimed in any one of the preceding claims in a container therefor.

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